

Case report

## Dramatic lightning injury with exit wound

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### Abstract

This is a case report of an environmental accident due to lightning where one school boy sustained current, blast, and flame effects of it. A bolt of lightning directly struck the pole of a football ground and the scatter struck the child. In addition to burn injuries, he showed an exit wound of lightning in left foot. The exit wound of lightning current is a very rare finding. The body of victim had flame and heat effect of atmospheric electricity on head and neck, face, and trunk. In this incidence of lightning other team mates of the victim were safe. The patient survived the attack.

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### 1. Introduction

Lightning is a momentary, atmospheric, transient, high current electrical discharge whose path length is measured in kilometers<sup>1</sup> from clouds to earth. It carries high voltage current via a huge arc to ground.<sup>1,2</sup> In tropical and sub-tropical countries accidental deaths from lightning are not uncommon. Most lightning discharges are within clouds, while some cause electrical discharge from a cloud to earth. Most human deaths are caused by cloud-to-earth lightning strikes.<sup>1</sup>

Malaysia has frequent rains with thundering and lightning. It is an important cause of weather-related morbidity and mortality in this area. The current can spread over the surface of the body, pass through the body, or can take a pathway inside as electricity passage through body.

Lightning injury can occur in five ways: direct strike, orifice entry, contact, side flash, and blunt trauma.<sup>7</sup> It has been experimented in sheep that lightning strikes near the head may enter orifices such as ears, mouth, and eyes

to flow internally.<sup>8</sup> Side flash or splash occurs as lightning jumps from its primary strike object to a nearby person on its way to ground.<sup>10</sup> Blunt trauma from lightning can occur from two mechanisms; first, the person may be thrown to a considerable distance by the sudden, massive contraction caused by current passing through the body.

Second, an explosive or implosive force occurs as the lightning pathway is instantaneously superheated and then rapidly cooled following the passage of the lightning.<sup>7</sup> Tympanic membrane rupture is commonly found in lightning victims and may be due to the shock wave and air blast effect.<sup>9,12</sup> In fact, ruptured tympanic membranes are the most common blast injuries found in lightning victims. Lightning acts as an instantaneous, massive direct current shock, simultaneously depolarizing the entire myocardium. The initial response to lightning stroke is paralysis of the vital center, resulting apnea, ventricular fibrillation, or cardiac arrest. The mortality rate from lightning is 30%, and up to 70% of survivors sustain significant morbidity.<sup>9</sup>

### 2. Case report

A 11-year-old school boy was playing football with his team mates in a big play ground having tall trees at its periphery. He was playing as goal keeper in the game

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and was near to the iron poles when lightning struck the place. In this case, probably lightning struck the iron pole and then hit him. He was brought in unconscious state to pediatric casualty of this hospital, and was referred to author for consultancy.

He had surface burns over face, neck, and trunk area as shown in Figs. 1 and 2. It made an heat and flame effect on head and neck, and trunk area. The lightning current had passed through left lower limb and resulted in bursting of his left foot. The shoes were also torn but those were not brought by the rescuer teams. Those were removed and disposed by them in an attempt to control bleeding. The exit wound in the left foot is shown in Fig. 3.

### 3. Discussion

Lightning incidents often involve more than one victim when current “splashes” to other individuals. In contrast,

it is also well known in lightening episode when a group or even two people who are standing near by one may be injured while other can go unharmed and unscathed. In this case also, other teammates of injured boy were not harmed.

He showed marked swelling of ear, eyelids, lips and also showed signs of cerebral edema on CT scan. He survived after 1 week treatment in the hospital. Intense edema of the skin develops at points of entry of current in those who survive, probably due to paralysis of local capillary and lymphatic vessels.<sup>3</sup>

The exit wounds due to electrocution can be seen in the literature but exit wound by lightning current is a rarity. In one earlier reported case, exit wound were present over the occipital, and groin area.<sup>4</sup>

Perforations in lightning are due to blast effect, as in this case. In similar lightning case, there were perforations of terminal ileum and descending colon.<sup>4</sup> One athlete survived lightning accident because he was wearing helmet.<sup>5</sup>



Fig. 1. Photograph showing burns due to lightning over head, face, neck, and trunk areas.



Fig. 2. Photograph showing burns and swelling of right side ear, upper lip, and right with blistering over left side chest of the victim.



Fig. 3. The photograph of left foot showing exit wound of lightning.

The external burns are very variable and are seen on arc-ing side. Recovery has been reported even after 4 h in one lightning episode.<sup>6</sup> Approximately one-third of lightning strikes are fatal.<sup>1,2</sup> Primary cause of death in lightning strike is cardiac arrest, which may be associated with pri-mary ventricular fibrillation or asystole.<sup>13,16,17</sup> Pulmonary contusion and haemorrhage are reported with lightning injury.<sup>14</sup> The cases which show more flame effect, disrup-tive clothing survive more in comparison to the cases which show minimum external effects. In one of the mass incident, 47 children were affected by lightning bolt in a playground, a detailed account of patho-physiology and its effect was given.<sup>11,18</sup>

Lightning injuries cannot be other than accident and pose no difficulty to the forensic pathologist.<sup>1</sup> Outdoor lightning victims are most often found in two categories: occupational and recreational. The players of outdoor games, joggers, outdoor workers, walkers are main victims of lightning accident. The lightning here, mainly strikes in the late afternoon and evening hours when mobility of the persons is more.

During thunderstorm in such areas shelter near poles, trees should be avoided. No place is absolutely safe from the lightning threat; however, some places are safer than others. The safest shelters are closed buildings, closed auto-mobiles, cave. Lying on ground with curled up hands together, although not 100% safe can be of some relief in compelling circumstances.

Most survivors are not directly struck by the lightning but receive electrical shock as a result of being in the close vicinity of a lightning strike.<sup>15</sup> Lightning should be treated like a crush injury, rather than a thermal burn, because of the large amount of tissue damage that is often present under normal-appearing skin.

## References

1. Maio Di Vincent JM, Dana Suzanna E. *Handbook of forensic pathology*. Landes Biosciences; 1999. p. 195–7.
2. Knight Bernard. *Forensic pathology*. 2nd ed. Arnold; 1996. p. 330–1.
3. Reddy KSN. *The essential of forensic medicine and toxicology*. 21st ed.; 2002. p. 283–284.
4. Sheela SR. An unusual case of lightning injury. *Indian Paediatr* 2000;**37**:802–3.
5. Steinbaum S, Harveil JD, Jaffin JH, Jordon MH. Lightning strike to the head: case report. *J Trauma* 1994;**36**:113–5.
6. Marcus MA, Thijs N, Meulemans AI. A prolonged but successful resuscitation of a patient struck by lightning. *Eur Emerg Med* 1994;**1**:199–202.
7. Copper MA, Andrews CJ. Lightning injuries. In: Auerbach P, editor. *Wilderness medicine: management of wilderness and environmental emergencies*. 3rd ed. St Louis: Mosby; 1995.
8. Andrews CJ, Darveniza M. Effects of lightning on mammalian tissue. In: *Proceedings of the international conference on lightning and static electricity*. Bath, UK; 1989. p. 104.
9. Cooper MA. Lightning injuries: prognostic signs for death. *Ann Emerg Med* 1980;**9**:134.
10. Arden GP et al. Lightning accident at Ascot. *BMJ* 1956;**1**:1453.
11. Andrews CJ, Darveniza M, Mackerras D. Lightning injury: a review of clinical aspects, pathophysiology, and treatment.. *Adv Trauma* 1989;**4**:241.
12. Bergstrom L et al. The lightning damaged ear. *Arch Otolaryngol* 1974;**100**:117.
13. Lichtenberg R, Dries D, Ward K, Marshall W, Scanlon P. Cardio-vascular effects of lightning strikes. *J Am Coll Cardiol* 1993;**21**:531.
14. Buechner HA, Rothbaun JC. Lightning stroke injury: a report of multiple casualties from a single lightning bolt. *Mil Med* 1961;**126**:775.
15. McCrady-Kahn Virginia, Kahn Arthur M. Lightning burns. *West J Med* 1981;**134**:215–9.
16. Apfelberg DB, Masters FW, Robinson DW. Pathophysiology and treatment of lightning injuries. *J Trauma* 1974;**14**:453–60.
17. Browne BJ, Gaasch WR. Electrical injuries and lightning. *Emerg Med Clin North Am* 1992;**10**:211–29.
18. Myers GJ, Colgen MT, Van Dyke DH. Lightning-strike disaster among children. *JAMA* 1977;**10**(5):238.